INFORMATION PAPER

Military Vaccine Agency
5 December 2012

SUBJECT: Typhoid Fever and Typhoid Vaccines

1. Purpose. To describe typhoid fever and the vaccines to prevent it

2. Facts.

a. Microbiology. Typhoid fever is caused by *Salmonella enteric* serovar Typhi (S.typhi). This highly infectious bacteria rapidly and effectively passes through the intestinal tract mucosa of the host. The resulting invasion results in a bacteremia. In cases where the bacteria invade the gall bladder, a patient can become a chronic carrier of typhoid bacteria.

b. Disease. Ten to fourteen days after infection a wide range of symptoms with varying clinical severity appear. Symptoms include a high fever, myalgia, anorexia, abdominal discomfort, loss of appetite, constipation, and headaches. The fever rises over a period of days and then remains at 102º to 104ºF. A flat, skin rash described as "rose spots" may appear in some cases. Severe complications of typhoid fever may involve intestinal perforation, hemorrhage, and even death.

c. Epidemiology. Humans are the sole reservoir for *S. typhi*. People with typhoid fever carry the bacteria in their bloodstreams and intestinal tracts. The infection is spread when people ingest food or water that has been contaminated with fecal matter. It can also spread via contaminated sewage that enters water sources used for drinking or washing food. Typhoid fever is still endemic in many developing countries with inadequate sanitation and water supply quality, where it is mainly a disease of school-age children. About 2% to 4% of acute typhoid cases result in the chronic-carrier state. Symptomless carriers are the natural reservoir for *S. typhi*. There are approximately 400 cases of typhoid fever reported annually in the United States, most acquired during foreign travel

d. Vaccine.

1) Typhim Vi® is an inactivated polysaccharide vaccine produced by Sanofi Pasteur. The vaccine is a sterile solution containing the cell surface Vi polysaccharide extracted from Salmonella enterica serovar Typhi, S typhi Ty2 strain. Phenol, 0.25%, is added as a preservative.

2) Vivotif® is a live attenuated oral vaccine produced by Crucell Switzerland LTD. The vaccine strain is lyophilized and filled into gelatin capsules which are coated

to render them resistant to dissolution in stomach acid. This vaccine contains no preservatives; each capsule contains sucrose, ascorbic acid, amino acid mixture, lactose, and magnesium stearate.

e. Cautions. The following people should not receive either typhoid vaccine: people with a history of serious allergic reaction to typhoid vaccine or have any hypersensitivity to any component of the vaccine. No information is available on the safety of typhoid vaccine in pregnancy; it is prudent on theoretical grounds to avoid vaccinating pregnant women and should only be given to a pregnant woman if clearly needed. When administering the oral vaccine individuals with an acute fever, gastrointestinal illness or currently receiving sulfonamides or antibiotics should be temporarily exempted until symptoms resolve and >72 hours since last dose of antibiotics. Individuals who cannot mount a humoral or cell-mediated immune response due to congenital or treatment/medication induced immunosuppressive state should be exempted.

f. Immunization.

1) Typhim Vi vaccine is licensed for persons 2 years of age and older. It is administered as a single 0.5-mL intramuscular injection in the deltoid. A booster dose is recommended every two years for persons who have prolonged exposure to potentially contaminated food and water.

2) Vivotif vaccine is licensed for persons 6 years of age and older. The vaccine consists of four (4) enteric-coated capsules supplied in a foil blister package. One (1) capsule is taken every other day on days 1,3,5,7. The capsules should be taken on an empty stomach, one hour before or two hours after a meal, with a cold or lukewarm drink. Care should be taken not to chew or break open the vaccine capsule. A booster is recommended every five years for persons who have prolonged exposure to potentially contaminated food and water.

g. Adverse Events. The most common adverse reactions to injectable typhoid vaccination are redness, swelling, and discomfort at the injection site. Nausea, skin rash, headaches, or a mild fever may occur. Potential oral typhoid vaccination reactions include abdominal discomfort, nausea, vomiting, diarrhea, fever, rash or headache.

h. DoD Policy. Vaccination is required for personnel during deployment to typhoid-endemic areas and other areas with poor sanitation systems. Typhoid immunization is generally required for members of units designated to be ready to deploy outside of the U.S. within 10 days of notification.

i. Special Considerations. The typhoid vaccines do not protect against S. *paratyphi* infection. Both typhoid vaccines protect 50%–80% of recipients; travelers should be reminded that typhoid immunization is not 100% effective, and typhoid fever could still occur. Vaccinated individuals should continue to take personal precautions against exposure to typhoid organisms and should be cautioned that vaccination is not a substitute for careful selection of food and drink.

3. References.

a. Centers for Disease Control and Prevention. Typhoid Immunization – Recommendations from the Advisory Committee on Immunization Practices (ACIP). MMWR 1994;43(RR-14):1-7.

b. Centers for Disease Control and Prevention. CDC Health Information for International Travel 2012. New York: Oxford University Press; 2012. http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-2-the-pre-travel-consultation/drug-vaccine-and-drug-drug-interactions.htm

c. Multiple resources (e.g., product insert, Vaccine Information Statements) assembled by Military Vaccine Agency: www.vaccines.mil/typhoid

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